Event Prediction for Modeling Mental Simulation in Naturalistic Decision Making

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Motivation

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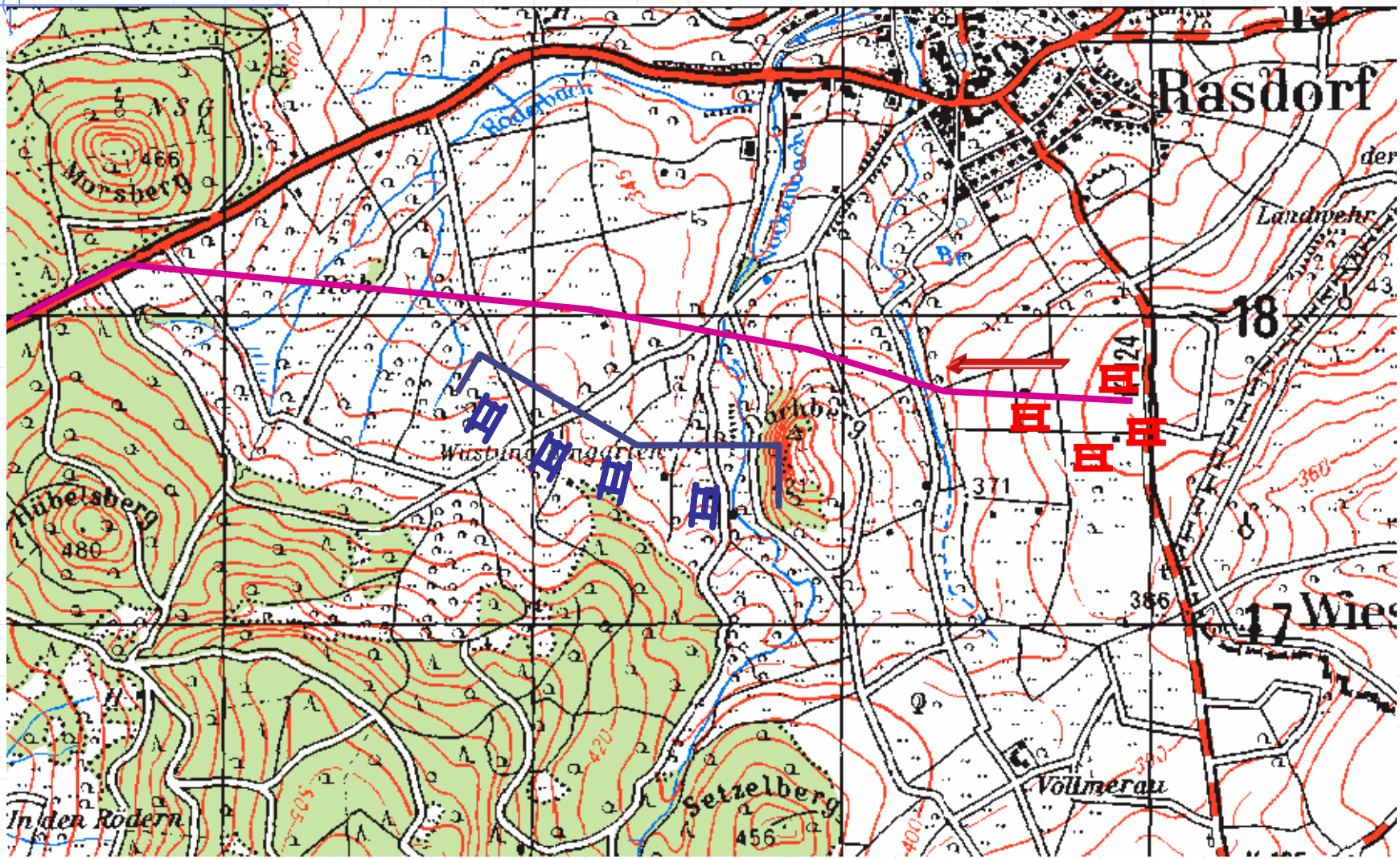
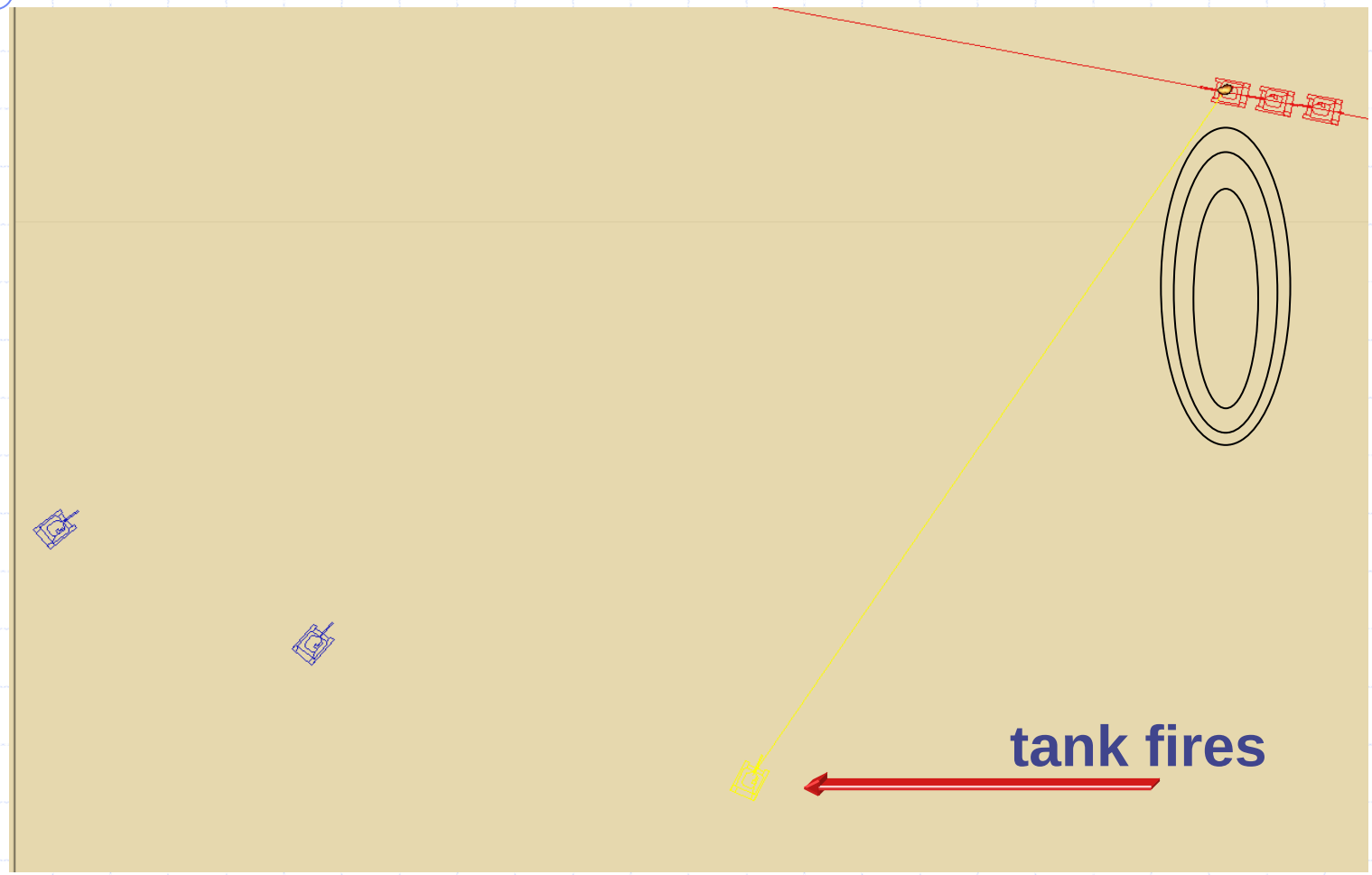
Naval Postgraduate School

Combined Arms Analysis Tool for the 21st Century

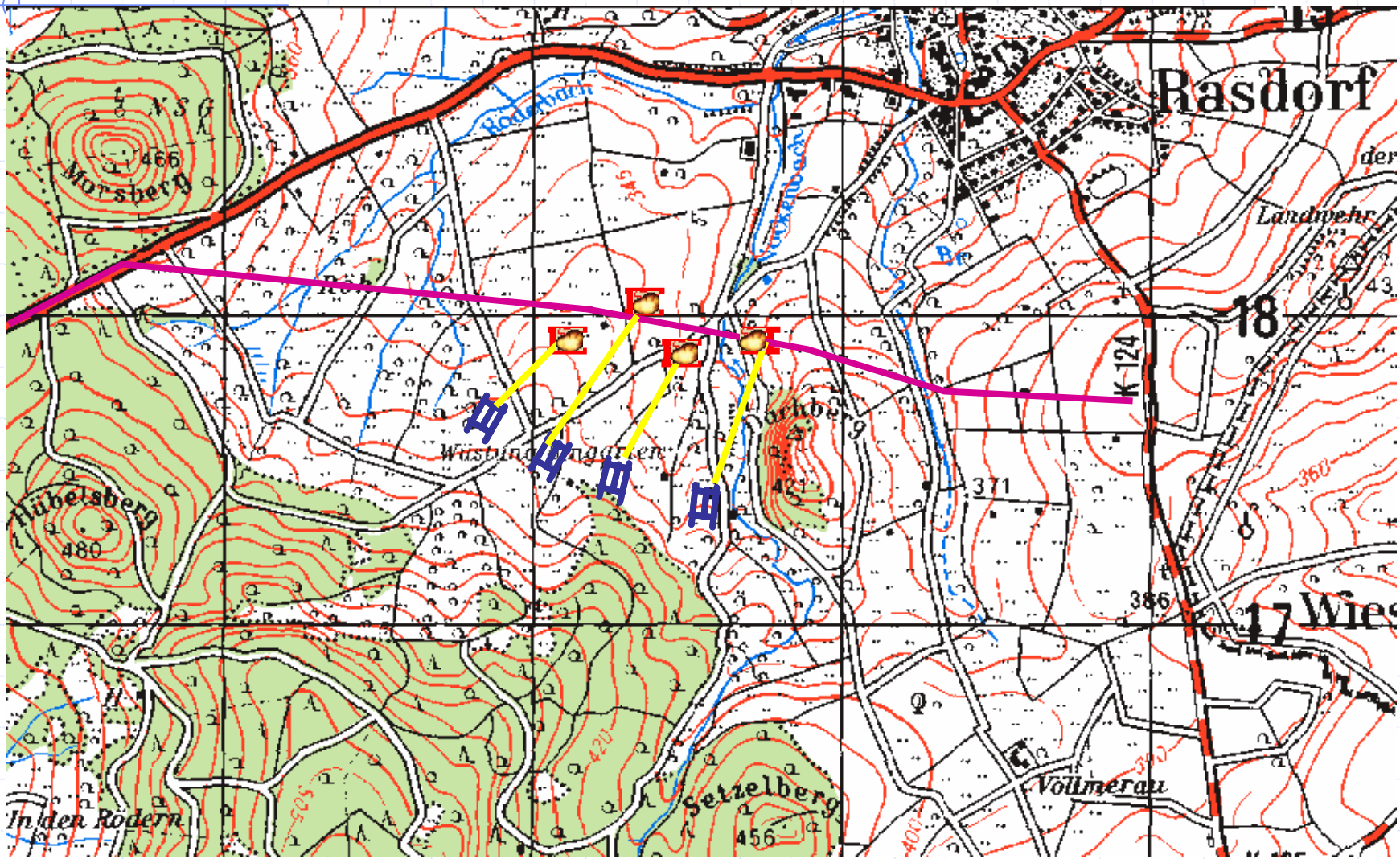
Scenario to illustrate Current Behavior



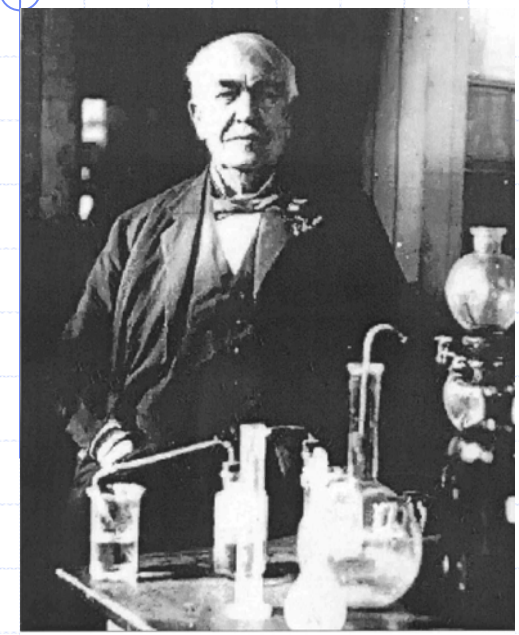
What happens in the Simulation:



What would have happened in Reality:



What could be done better? Benefits?



"There is always a way to do it better... find it!"

- Ability to predict what will happen in the near future
- Agent could be more sensitive to context e.g., recognition of certain situations, terrain, mission; will be an enhancement of the situational awareness
- Determination of the potential actions of an agent
- Provision of an explanatory component for the reasoning of an agent

Thesis Statement

This thesis attempts to show that the methodologies of statistical event prediction can be used to effectively model mental simulation.

"Mental simulation" in this context means the ability of software agents to simulate future events in order to evaluate their own courses of actions in combat simulations and to hypothesize events that might occur given the current and past situation.

Decision Making

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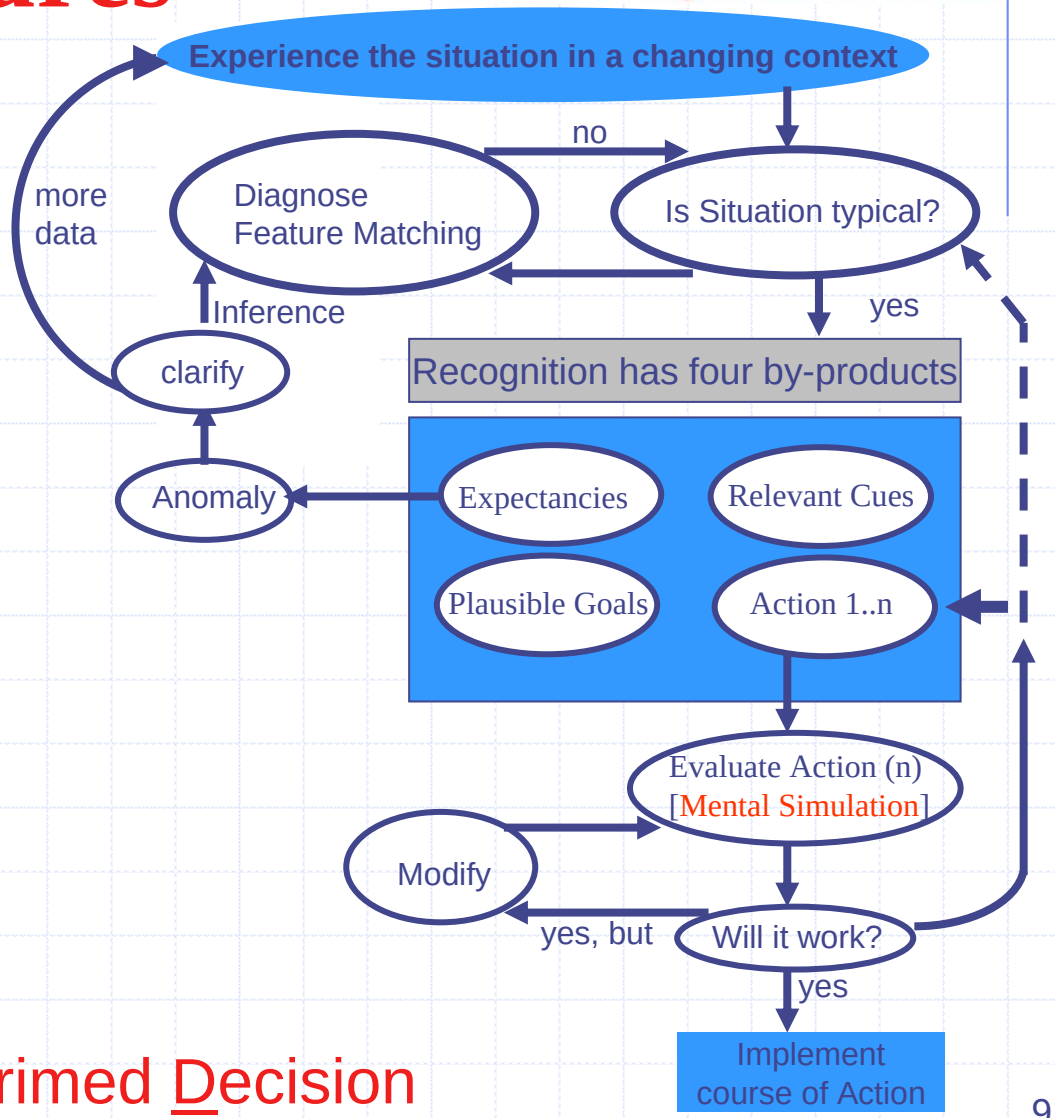
The study of military tactical planning and decision-making has shown that experienced commanders, quite contrary to what is prescribed by traditional military prescriptive planning models, make intuitive decisions based on recognition and mental simulation (Thunholm, 2000).

Naturalistic Decision Making - Features

- Decision Process used by experienced decision makers in order to arrive at satisfactory decisions
- Uncertain environment
- Evaluation of a single option
- Time stress
- High stakes



RPD: Recognition-primed Decision

Mental Simulation within the Navy

…decision models should represent the reasoning and behavior of commanders at different levels, naturally reflecting the actions, plans, and adaptations that commanders make…. (Committee on Technology for Future Naval Forces, 1997)

The Department of the Navy may need to train commanders in recognizing patterns in typical cases and anomalies encountered in operations to improve their mental simulation skills and enable quicker and better decisions

(Naval Studies Board of the National Research Council, 2000).

Prediction Techniques

- simple approach (strawman)
- linear models (for subset of data)
  - Kalman Filtering
  - Box-Jenkins, ARMA
- non-linear models
  - Hidden Markov Models
  - Dynamic Bayesian Networks

Summary

- Not an automated decision maker for an entire scenario, no relation to a Turing-Test
- Predicting what will happen in the near future will contribute to the autonomy of the system
- The more autonomous the system will be the more the workload of the pucksters will be reduced
- Modeling mental simulation opens opportunities for agents to be more proactive rather than just reactive.

What is next?

- Start with a particular scenario in CXXI
- Look at the data available and how they match the requirements for the different models
- Try different prediction techniques
- Look at different scenarios in order to get generalization
- Determine what prediction technique is most suitable for military simulation domain